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tion of every special development of knowledge or of aptitude that is to lift a man to his profession or a scholar to his function of investigation.

I have studied the history of America; I have seen her grow great in the paths of liberty and of progress by following after great ideals. Every concrete thing that she has done has seemed to rise out of some abstract principle, some vision of the mind. Her greatest victories have been the victories of peace and of humanity. And in days quiet and troubled alike Princeton has stood for the nation's service, to produce men and patriots. Her national tradition began with John Witherspoon, the master, and James Madison, the pupil, and has not been broken until this day. I do not know what the friends of this sound and tested foundation may have in store to build upon it; but whatever they add shall be added in that spirit, and with that conception of duty. There is no better way to build up learning and increase power. A new age is before us, in which, it would seem, we must lead the world. No doubt we shall set it an example unprecedented not only in the magnitude and telling perfection of our industries and arts, but also in the splendid scale and studied detail of our university establishments: the spirit of the age will lift us to every great enterprise. But the ancient spirit of sound learning will also rule us; we shall demonstrate in our lecture rooms again and again, with increasing volume of proof, the old principles that have made us free and great; reading men shall read here the chastened thoughts that have kept us young and shall make us pure; the school of learning shall be the school of memory and of ideal hope; and the men who spring from our loins shall take their lineage from the founders of the republic.

WOODROW WILSON.

THE CARNEGIE INSTITUTION.

THE trustees of the Carnegie Institution obviously have an exceedingly difficult task on their hands. The difficulty is not so much due to the magnitude of the endowment as to the uniqueness of what they have to do. They are launched in very imperfectly charted waters where there are many hidden dangers, and they will have to drive their ship forward much of the time under a slow bell and probably will have to reverse her engines occasionally. But this method of navigating will meet the approval of a great majority of the scientific men of the country, just because they will recognize the conditions under which it is being done and will see it to be the best method.

The trustees would be justified in putting a plank into their policy to the effect that *nothing shall be undertaken, for some years at least, that cannot be easily changed or even given up should the course of events make it best to do so*. In fact I imagine that about this policy is tacitly expected by most scientific men. For example, I suspect my own surprise at the announcement that the institution had acquired the Woods Holl Laboratory and had pledged itself to erect an expensive building and spend \$20,000 a year in running it was rather widely shared by those like myself who are keenly interested on-lookers.

This remark is not at all intended as a criticism, for although it is difficult to see from the distance of California how the move could have been the wisest that might have been made, yet I do not doubt that, seen from within, there were good and sufficient reasons for making it. My only point is that the announcement surprised me because I had not supposed it would be the policy of the institution, at the outset of its career at any rate, to do that sort of thing.

It may not be unprofitable to consider briefly what in accordance with the policy here suggested the attitude of the trustees might be expected to be in a specific case.

To help along that great class of scientific publication which cannot be carried by publishing houses on a strictly commercial basis would be one of the very important aids that the institution might render science. Supposing it were resolved by the trustees to give a hand here, how shall this be done would of necessity be a foremost question. A number of courses would be found open, all promising well. One would be to build and operate a large publishing house at some central point. This might either establish its own journals and series of monographs for the various departments of learning; or it might act merely as a printing house for reputable journals, etc., now existing, but whose existence is a constant struggle for life.

A second general method would be to grant sums of money, of course under carefully considered conditions, to existing publications, permitting the managers of these to use the money as they best might for broadening the scope and improving the quality and efficiency of the publications for which they are responsible.

Either of these general plans of aid well carried on would work great improvement to the present highly unsatisfactory state of scientific publication in this country. If one of them were to be adopted, which should it be? Were there absolute certainty that either would be best, that of course would answer the question. Certainty, however, would not be possible. On the whole the probabilities would rather favor the first plan, it seems to me. Nevertheless since the second plan would be *almost* as likely to succeed as the first, it would be adopted as it could accord better with the cut-and-try policy. The first plan would involve the permanent investment of

a large sum of money in a plant, and this plant, unusual as it would have to be in much of its equipment, could not be readily disposed of should it be found desirable to do this. Furthermore, should series of publications be inaugurated by the institution itself it would be a serious matter to discontinue them. On the other hand, money grants of the sort contemplated in the second plan could be easily modified or discontinued at any time should they be found by the trustees not to be producing satisfactory results. More than this the adoption of the second plan would be favored by the considerations that it would be supplementing and not supplanting experience and well-directed effort 'in the periphery'; and further that it is greatly to the advantage of both libraries and users of libraries that long-established journals should be kept up and improved rather than that new ones should be established.

But the most fundamental difficulty confronting the trustees will be that of so using the funds and influence in their hands as to make them contribute most to the promotion of science, and of accomplishing this without impairing 'activity in the periphery,' to use Professor Münsterberg's happy phrase.

It is easily conceivable that the ranking of our nation among others on the basis of scientific research might be advanced many points, but that this might be accompanied by an actual falling off in such peripheral activity. Promotion at such a cost would, I think, be regarded by most American men of science as having been bought at a price above its worth. Local initiative, wherever found, rewarded solely according to its merit is, after freedom, the most sacred thing to American science as it is to everything else American. Centralization of the sort that produces a weakening of peripheral effort and responsibility is hateful to us; hateful not merely from a na-

tional sentimentalism, but because we know it means the acceptance of one or the other of nature's two alternative penalties for such relief: death or the transformation into a new species. For neither of these are we ready.

But the trustees understand all this. It is not because they need instruction concerning their duties in this regard that so many of the scientific workers voice the conviction here emphasized. Rather it is because we hope it may be assuring to them to have our own declaration that we do not want to be relieved from the efforts we are now constantly making to obtain the means for pushing on our scientific enterprises, but that what we should like would be such a dispensation that our worthy efforts might count for something—might count for as much as they deserve.

Without making the rule a hard and fast one, I should certainly say that aid should be granted on condition that the sum granted be duplicated by those asking it. Professor Branner makes the objection that this condition would usually bar the possibility of getting the needed help since scientific men are rarely in touch with business men of wealth. My reply to this is let us get into touch with such men. It will do both us and them good, whether we succeed in getting their financial assistance or not. I speak from considerable experience here.

For the present I believe the aiding of researches already well planned, frequently far on the way to results, but which are struggling against hope almost for the funds necessary to carry them forward, might advantageously compass the aims of the institution. It is just in the midst of such undertakings that the exceptional man whom Mr. Carnegie is after will be found.

Of course many difficulties beset the way here, such as that of deciding on the merits of the undertakings for which aid is so-

licit; and of making sure that the money is being used to the very best advantage after it has been granted. But these difficulties are far from insurmountable. The institution might well profit by the experience and methods of the scientific departments of the national government in sending experts to the localities to get information as to the merits of particular schemes by actual inspection and conference.

It may be noted incidentally that a strenuous application of the helping hand policy would almost inevitably carry with it the making more available for investigators the treasures of material and literature at the national capital. It seems, however, as though the government itself might do this. But if it will not, the institution would have to do it to the extent of its ability.

WM. E. RITTER.

UNIVERSITY OF CALIFORNIA,
October 14, 1902.

I HAVE already, in a written communication to its trustees, partially expressed my views upon this subject, having suggested that it be made a center for the systematic collection and classification of scientific literature. In brief that suggestion was that there be organized at once a working force, drawn largely from the needy and worthy post-graduate students of our leading universities (who, while doing this work at Washington, and thereby becoming self-supporting, could also avail themselves of the many opportunities there offered for advanced study both by day and night), and that this particular undertaking should be the preparation of an extended series of scrap books, or rather special binder files, into which could be inserted clippings and excerpts from the various text-books, periodicals, transactions of learned societies, etc., classified as to chemistry both by the individual chemical bodies, and also by some suitable subject-

title scheme; and as to physical and other sciences, both by broad general titles, and by physical data and properties as well.

The plan would mean much clipping from several copies each of such works as the *Berichte*, the journals of the various chemical and physical societies, the *Philosophical Magazine*, etc., and would be a work of great magnitude, requiring for its accomplishment a large force, and it would be a permanent undertaking.

If the Carnegie Institution is to maintain a research laboratory at Washington, the uses of such a collection of specially classified literature would be invaluable and obvious, and even if not, it would seem that one such great reference collection (and it is not likely that there would ever be another) would certainly be well located at such a center of scientific inquiry as the national capital.

To go a step further, however. To what uses could such a collection be put by this institution?

Evidently when once made, it would be invaluable in the preparation of a series of volumes for widespread distribution, along the same lines, but in a much more extended way, of the very excellent compilations on the constants of nature already published by the Smithsonian Institution, with which the name of Professor F. W. Clarke is already associated.

Such subjects as boiling points, melting points, specific gravities, specific heats, electrical constants, thermochemical constants, constants of refraction, coefficients of expansion, etc., would each form separate volumes of a complete and uniform series, and then a series of annual volumes would naturally be issued, bringing them all up to date from year to year; and the preparation and publication of such an invaluable encyclopædia of physical and chemical constants, would be a work well worthy the attention of the Carnegie Institution, and

one not at all likely to be accomplished by any other agency; and of its great practical value, scientific as well as industrial, there can be no question whatever.

Moreover, an annual series of volumes on the progress of the year in chemical, physical and other scientific research would also be very acceptable.

All such work would naturally bring out very clearly the numerous determinations of physical and chemical constants, which have either never yet been made, or else have been made in such a manner as not to inspire one with confidence in the accuracy of the published results, and it is along these lines of research that there would seem to be a great need for an extensive and well-equipped research laboratory, located at Washington, and having in hand the determination of chemical and physical constants, wherever the researches of former investigators have passed them by undetermined. One would hardly credit how very incomplete existing data are, unless he has been engaged in some research work and by actual investigation has learned how few comparatively are the known constants, as compared with those still awaiting determinations, and which are only too often so badly wanted.

Naturally this institution would also become a head center, through the good offices of which the work of independent collaborators, at the many laboratories of this and other countries, could be so regulated and planned as to secure cooperation along important lines of research while avoiding unnecessary duplication of work. Such a research laboratory would also naturally take up, from time to time, special lines of original research work, but its regular every-day routine work would be largely on the determination of those chemical and physical constants, particularly of the rarer and very expensive elements and com-

pounds, which are at present so greatly needed but so little known.

The institution would of course always stand ready to afford to competent workers, pursuing special lines of research of general scientific interest, special laboratory facilities, aiding them with grants of expensive material and the loan of costly apparatus in all cases where the circumstances justified it.

This in short is what I think the Carnegie Institution ought to become, viz., a great center for the classification and publication of past and current scientific literature, on a scale never before attempted. A great center of physical and chemical research on the various constants of nature, as well as a place where special chemical, physical and other scientific research on any subject of sufficient importance could be initiated, fostered, and aided, and finally a bureau of publication, where the ultimate results of all these activities could be published and widely distributed, for the general benefit of mankind.

EDWIN A. HILL.

WASHINGTON, D. C.,
October 14, 1902.

TO THE EDITOR OF SCIENCE: As one who has recently been concerned with laboratory research, who has had to encounter the difficulties incident to the publication of a doctorate thesis and who is now professionally interested in educational work, may I be pardoned for expressing my opinion in regard to the application and distribution of the Carnegie fund?

It is a fact that in America the scientific career holds out no such inducements of a social or civic sort as does a similar career abroad, notably in England and Germany, where decorations, titles and various public honors both furnish an incentive and reward within professional circles and bring men of science and the public into

closer touch, to the mutual advantage of both. However true it may be that the investigator's work is its own reward, it is probably equally true that the cause of science across the water has profited by the existence of such honors. It has seemed to me that the Carnegie Institution, if devoted to a single purpose, might bring about similar conditions on this side of the Atlantic.

The first thing, therefore, that the announcement of the fund suggested to me, and I doubt not to others, was the establishment of a great institution not only for the purposes of administration but also for the prosecution of research, a Mecca for men of science, a university of universities, controlled by a body of men of acknowledged ability and peopled by graduate students (perhaps solely by men who had already received their doctorate) whose merit had been tested. Appointments for a term of years (for I presume that rotation would be the most desirable policy) to the chairs and instructing staff of such an institution would go far toward a remedy of the existing deficiencies in the incentives for honors in American science. The students might be selected by competitive examination from a list of candidates indorsed by the universities or chosen without actual examination by a tribunal of competent authorities after inspection of their credentials.

I am aware that the idea of a central institution for the prosecution of actual research has been condemned by men whose opinions are far weightier than mine. President Harper, for instance, has said that if the Carnegie fund, instead of encouraging and strengthening the work where it already exists, 'undertakes to establish new foundations, independent of these institutions, in order that its own work may be more tangible, it will prove to be the greatest curse of higher educa-

tion in this country instead of a blessing.' While it may seem overbold to question the conclusions of one who has attained an inside view of the problems of the American university, I cannot but feel that the coming generation, of the scientific investigators at least, would be cheered by the prospect of a great Carnegie institution of research.

If, on the other hand, the fund is to be bestowed upon various objects, there can be no doubt, from the student's point of view, as to what directions the expenditure should take in the main. The assistance of publication is, I believe, one of the definitely marked out avenues for the distribution of the fund. I believe that such assistance should be accorded not only to those who conduct research by the aid of the fund, but also to those who conduct independent investigations. The publication of the doctorate thesis seems unnecessarily difficult. It seems odd, at first thought, that the results of two or three years of research not only do not command any financial return, but are actually, as published, sources of expense to the author. If some journal undertakes to publish the research, the writer has often to pay extra charges of various sorts—excess for proof corrections, excess for tables, excess for fine print, excess for over-length—and the off-prints and their distribution add to his indebtedness to the publisher. Even so, I am informed that certain scientific journals are actually conducted at a financial loss, and hence at the personal expense of the editors, unless subsidized by some university. Here, then, are two matters which are not as they should be, and might well concern the Carnegie fund. Could not these difficulties be met in two ways: (1) By the restriction of the number of existing scientific journals, especially by amalgamating the numerous scattered 'studies' of various universities with the leading

journals, and (2) by the establishment of a Carnegie Bureau of Printing and Engraving where these standard journals should be printed at an expense no greater than that of the European journals? The cost of publishing could thus be removed from the investigator and assumed by the fund, while the journal, if not then self-supporting, could be aided, possibly, by judicious subsidizing.

I believe, further, that much good would come if these journals, thus amalgamated and thus placed upon a satisfactory financial basis, were supplemented by the publication, for each science, of a 'Carnegie year-book,' giving a full account of the work of the various laboratories (*résumés* of published articles, description of new apparatus, etc.). This work might profitably, perhaps, include some record of work abroad. Finally, the journals and year-books might be supplemented further by a series of authoritative monographs, published under the auspices of the fund, upon topics within each science. There seems to be a place now for comprehensive historical *résumés* as complete, even if not at all original, as Helmholtz's '*Handbuch der physiologischen Optik*.'

Another obvious avenue of disbursement is the establishment of fellowships and scholarships for graduate students in the universities. If the universities would agree to remit the tuition of all Carnegie fellows and scholars, five hundred and three hundred dollars respectively would give ample provision for the bodily wants of the holders. The scholars might be regarded as presumptive fellows, to be promoted in accordance with the recommendation of their university instructors. Both scholars and fellows might be appointed simply as Carnegie fellows and Carnegie scholars, and allowed to select the university at which they would conduct their studies.

Finally, I believe that there is need of assistance to existing laboratories for the purchase of equipment for new lines of research too extensive to be undertaken by the university, and also for the establishment of small typical laboratories in institutions that can not afford to provide for them. There are few universities that deal so bountifully with every department of research that further material acquisitions are not earnestly desired. Nor is there any reason why, as some have intimated, it should be considered in any sense an indication of incapacity or niggardliness for any university to allow its departmental distributions to be supplemented by donations from the Carnegie fund. The wealthiest university has unsatisfied needs, and Mr. Carnegie's generosity has no flavor of charity.

If I may be allowed to plead for the form of investigation in which I am just now personally interested, I should mention the establishment of psycho-educational laboratories as a subject worthy of the consideration of the administrators of the fund. However great were the differences of opinion which the discussion in 1898 revealed, there was a striking unanimity in the utterances of Professors Titchener, Royce and Münsterberg, all three of whom independently urged the necessity of a linking science between psychology and education. I believe that the plan of establishing psycho-educational laboratories in conjunction with the psychological and educational departments of universities is one of the obvious means for the practical execution of these plans. If, for instance, several such laboratories could divide between them such a question as the methods and values of 'psychometric' tests upon students, a very important problem could be satisfactorily settled. And this is but one of a host of problems.

To summarize, I have advocated (1)

that, if practically the whole fund is to be devoted to a single purpose, the establishment of a central institution for the transaction of research would best meet the needs of science in America (especially by supplying some inducement and visible reward for service which would attract men of ability to the profession), (2) that, if the fund is to be, for the most part, divided, its objects should include (a) the assistance of publication by the amalgamation of journals, the establishment of a Bureau of Printing and Engraving, the publication of 'year-books' and monographic reviews, (b) the establishment of fellowships and scholarships in existing institutions for graduate students, (c) the assistance of existing laboratories and the foundation of new laboratories in the universities—a need especially felt in the application to educational theory of the results of the science on which it is in part based.

GUY MONTROSE WHIPPLE.

TO THE EDITOR OF SCIENCE: Scientific research in the past has been made by men who have been workers in college or university laboratories and who have in many cases taught at the same time. This is true of such research the world over. It does not seem to me necessary, in order to promote research, to build new laboratories, to found a special institution or to spend money on a plant. Let present facilities which are open to all and are available in all parts of this country be utilized. There is to-day no lack of laboratory space. If there were it would be far better to increase the size of existing laboratories by moderate appropriations than to create a new one by a large expenditure. Let us have all the money for the direct purpose of aiding research.

Scientific research progresses slowly, each step being a short one, making a little advance from the previous position. It is

the man already at work who sees the opening and makes the step. He is the man to be helped. It is a waste of money to employ new men untried in work. No amount of money will produce scientific discovery. But when the man is known money may help him. Such men are known and are now at work in every laboratory in the country. Some are the heads of the laboratory. These men can employ others to do work of a tiresome necessary kind to help their own work. Others are younger workers with bright ideas which may be worked out under the direction of the head of the laboratory. I believe that every scientist to-day knows of two or more men whom he could select to do good work and who need help. I know two in my department who could do far more than they are doing if I could give each \$2,500 a year and thus relieve them of some drudgery of teaching. I would not have them give up teaching. It is the best stimulus to work. Let each head of a laboratory or head of a department in our universities have permission to present the claims of workers known to them, whose quality of work is good, and who need assistance, to the board of managers of the Carnegie fund. Let that board decide the relative value and need of the claims presented and place the money where it will do most good. In this manner research can be aided directly, without any machinery.

The publication of the results of research is much hampered in this country by the expense of illustration. There are plenty of magazines in each department ready to publish work, if the cost can be met. Let the board of managers have the power to make appropriations to individuals to cover the cost of publication, after the particular work in question receives the approval of some recognized authority, *e. g.*, the head of the laboratory where the

work is done. No new printing-office is needed. Let present facilities, open to all and ample, but expensive, be utilized.

It seems to me a waste of funds to put up a building for the use of scientific associations. They can hire halls, as they have always done, and thus meet, as they should, in different localities at different times.

Nor do I think the worthy members of such associations need or would accept free tickets to such meetings.

It seems to me, therefore, that the board of managers of the Carnegie fund should apply the fund to aid men now working in science along the regular lines which have hitherto been found practicable, and to utilize facilities which have been found ample in the past.

M. ALLEN STARR.

I HAVE not given the organization of the Carnegie Institution sufficient thought to warrant me in offering advice as to the best manner in which the fund can be used, and I do not like to go into the discussion of so important a matter with less preparation than would have been necessary if the directors had asked my help; so I am sure you will understand why I do not feel like complying with your request for an article for SCIENCE. The results of the steps taken at the start are likely to be so far-reaching, and the possibility of adequate consideration is so untrammelled, that I hardly think that the trustees will commit themselves until they are sure that they have formed a right opinion—except that they may take some isolated step, like the acquisition of the Wood's Hole laboratory, that may subsequently embarrass them as a precedent, without, however, committing them if, in their own judgment, it is not in line with their final policy when this is crystallized.

I have read the proof slips of your

article with a good deal of interest, and I do not at all question your feeling that the discussion of the possibilities of the gift while the organization is yet forming can hardly result in embarrassment, and ought to materially help the trustees. I quite agree with you that there ought to be found a better plan than the permanent shouldering of the burden of a large research establishment, and particularly of one devoted to one department of science if this is to prevent the reaching of a helping hand in other directions, as time brings their needs to light. And I quite agree with you that it would be unfortunate in the long run if the fund, which, though large, is not unlimited, were to be invested in any project which the Government or any of the better equipped existing institutions could undertake, perhaps with the temporary aid that you suggest. To come into the field of any of the Government bureaus that have ample publication funds would, as you well say, result in little if any good, and might actually do harm.

In a nutshell, while I have not given the matter enough thought to warrant the publication of a suggestion even, I have supposed that the opportunity of the Institution lies in the day-to-day and year-to-year use of its funds for the furtherance of the work of any earnest worker in need of aid—whether an individual or an institution. This presupposes the conservation of any sum not needed at any given time, against the day of its real need, with an unusual amount of earnest search for the best place of using it at any given time—for there is no doubt that the most worthy individuals and institutions that could use it are likely to be least forward in applying for aid, either from pride or modesty.*

WM. TRELEASE.

* The above letter was not written for publication, and was received before the current discussion had been begun, but is printed with the consent of the writer.

PRESSURE of official duties makes it impossible for me to write at present an article on the Carnegie Institution. You are, however, at liberty to quote me to the effect that it would be inadvisable for the institution to erect either a geophysical laboratory at Washington or to acquire the Marine Laboratory at Wood's Hole. I think that the policy should be followed of promoting geophysical researches along lines not specifically treated by governmental institutions. Men of parts and ability should be encouraged by grants, under such restrictions as to continuance from year to year as would produce results. Many permanent officials should be discouraged; it is difficult to get rid of a man when he once holds office, no matter if it is evident to every one that his mental powers and physical energy are waning. I do not believe that there should be any large laboratory built by the institution, believing that more effective work and better results could be obtained by subsidizing laboratories now in existence. In short, I hold that the activities of the institution should be kept well in hand under the control of the central commission, so that the rapidly shifting phases of research may receive timely attention through the abandonment of some lines and the taking up of others. This would make the Carnegie Institution in a way the center of the spirit of scientific investigation of the United States.

A. W. GREELY.

SCIENTIFIC BOOKS.

Animal Activities. A First Book in Zoology. By NATHANIEL S. FRENCH, Ph.D. New York, Longmans, Green & Co. 1902. Pp. xxi + 262, with illustrations.

Elementary Zoology. By VERNON L. KELLOGG, M.S. New York, Henry Holt & Co. 1901. Pp. xv + 492, with illustrations.